We claim:

1. An image enhancement process comprising the steps of:

a windowing process that selects a sub region of an image;

determining a value for each of one or more characteristics of the sub region, the characteristics being of a subject of the sub region;

defining one or more classes of the sub region from the values;

selecting one or more transform filters obtained using the learning/training process, that corresponds to each class; and

successively applying the transform filter to the sub region having the same class as the transform filter to obtain a transformed sub region.

2. The process, as in claim 1, where two or more transformed sub regions are combined to produce an enhanced sub region.

3. The process, as in claim 2, where the transformed sub regions are combined using a weighted summation of the transformed sub regions.

4. The process, as in claim 1, where one or more of the sub regions are determined by any one or more of the following: a pixel-wise amplitude of the sub region, an average amplitude of the sub region, an image frequency of the subregion, an orientation of the sub region, an amplitude transistion in the orientation direction, a local contrast, a local phase, a scalar quantization of intensity values of the sub region, a vector quantization of intensity values of the sub region, a dryness measure of the sub region, a smudge measure of the sub region, a quality of the sub region, an average amplitude of the enitre image, an average frequency of the entire image, an average quality of the entire image, and an average orientation variation of the entire image.

5. The process, as in claim 1, where a number of the sub regions is determined by any one or more of the following: a pixel-wise amplitude of the sub region, an average amplitude of the sub region, an image frequency of the subregion, an orientation of the sub region, an amplitude transition in the orientation direction, a local contrast, a local phase, a scalar quantization of intensity values of the sub region, a vector quantization of intensity values of the sub region, a dryness measure of the sub region, a smudge measure of the sub region, a quality of the sub region, an average amplitude of the entire image, an average frequency of the entire image, an average quality of the entire image, and an average orientation variation of the entire image.

6. The process, as in claim 1, where a shape of the sub regions are determined by any one or more of the following: a pixel-wise amplitude of the sub region, an average amplitude of the sub region, an image frequency of the subregion, an orientation of the sub region, an amplitude transition in the orientation direction, a local contrast, a local phase, a scalar quantization of

intensity values of the sub region, a vector quantization of intensity values of the sub region, a dryness measure of the sub region, a smudge measure of the sub region, a quality of the sub region, an average amplitude of the entire image, an average frequency of the entire image, an average quality of the entire image, and an average orientation variation of the entire image.

7. The process, as in claim 1, where an extent of overlap one or more of the sub regions is determined by any one or more of the following: a pixel-wise amplitude of the sub region, an average amplitude of the sub region, an image frequency of the subregion, an orientation of the sub region, an amplitude transition in the orientation direction, a local contrast, a local phase, a scalar quantization of intensity values of the sub region, a vector quantization of intensity values of the sub region, a dryness measure of the sub region, a smudge measure of the sub region, a quality of the sub region, an average amplitude of the entire image, an average frequency of the entire image, an average quality of the entire image, and an average orientation variation of the entire image.

8. The process, as in claim 1, where the characteristics are image characteristics that include any one or more of the following: a pixel-wise amplitude of the sub region, an average amplitude of the sub region, an image frequency of the subregion, an orientation of the sub region, an amplitude transition in the orientation direction, a local contrast, a local phase, a scalar quantization of intensity values of the sub region, a vector quantization of intensity values of the sub region, a dryness measure of the sub region, a smudge measure of the sub region, a quality of the sub region, an average amplitude of the entire image, an average frequency of the entire

image, an average quality of the entire image, and an average orientation variation of the entire image.

9. The process, as in claim 1, where the characteristics are subject characteristics that include any one or more of the following: sex, geographical location, weather, income, profession, and genetics.

10. The process, as in claim 1, where the image is a fingerprint image.

11. The process, as in claim 1, where the transform filter is chosen from a class that is near to the selected class (e.g., when the filter specified sub region class is not available due to lack of training data, or when choice of multiple transformation filters is available due to overlapping image division process).

12. The process, as in claim 11, where near is defined by any one or more of the following: a least square distance, an absolute distance, and an ordinal distance.

13. The process, as in claim 1, where the characteristic is amplitude and the value is an amplitude intensity value.

14. The process, as in claim 1, where the characteristic is the ridge orientation in a neighboring subregion and the value is orientation of the ridge with respect to x-axis in t-multiples of degrees.

15. The process, as in claim 14, where t=90.

16. The process, as in claim 1, where the characteristic is image frequency and the value is a cycle per distance value.

17. The process, as in claim 1, where the characteristic is a quality and the value based on an image type.

18. The process, as in claim 1, where the characteristic is a texture and the value is based on a pattern repetition value.

19. The process, as in claim 1, where the characteristic is an amplitude transition and the value is one of a: positive, negative, and zero.

20. The process, as in claim 1, where the characteristic is a perpendicular amplitude transition and the value is one of a: positive, negative, zero.

21. The process, as in claim 1, where the characteristic is an orientation variation and the value is the standard deviation of orientations in the neighborhood.

22. The process, as in claim 1, where one or more of the transformed filters is applied more than once to obtain the transformed sub region.

23. The process, as in claim 22, where the number of times the transform filter is applied is predetermined.

24. The process, as in claim 22, where the transform filter is applied until are condition is met.

25. An image learning process comprising the steps of:

a first windowing process that selects a test sub region of a test image;

a second windowing process that selects a true sub region of a true image, the test sub region corresponding to the true sub region;

determining a relation between one or more characteristics between the true and test sub regions;

determining a transform filter for each characteristic for each sub region, the transform filter able to transform the test sub region to the true sub region; and

associating the transform filter with relations.

26. The process, as in claim 25, where one or more of the test and true sub regions are determined by any one or more of the following: a pixel-wise amplitude of the sub region, an average amplitude of the sub region, an image frequency of the subregion, an orientation of the sub region, an amplitude transition in the orientation direction, a local contrast, a local phase, a

scalar quantization of intensity values of the sub region, a vector quantization of intensity values of the sub region, a dryness measure of the sub region, a smudge measure of the sub region, a quality of the sub region, an average amplitude of the entire image, an average frequency of the entire image, an average quality of the entire image, and an average orientation variation of the entire image.

27. The process, as in claim 25, where a number of the test and true sub regions is determined by any one or more of the following: a pixel-wise amplitude of the sub region, an average amplitude of the sub region, an image frequency of the subregion, an orientation of the sub region, an amplitude transition in the orientation direction, a local contrast, a local phase, a scalar quantization of intensity values of the sub region, a vector quantization of intensity values of the sub region, a dryness measure of the sub region, a smudge measure of the sub region, a quality of the sub region, an average amplitude of the entire image, an average frequency of the entire image, an average quality of the entire image, and an average orientation variation of the entire image..

28. The process, as in claim 25, where a shape of the test and true sub regions are determined by any one or more of the following: a pixel-wise amplitude of the sub region, an average amplitude of the sub region, an image frequency of the subregion, an orientation of the sub region, an amplitude transition in the orientation direction, a local contrast, a local phase, a scalar quantization of intensity values of the sub region, a vector quantization of intensity values of the sub region, a dryness measure of the sub region, a smudge measure of the sub region, a quality of the sub region, an average amplitude of the entire image, an average frequency of the

entire image, an average quality of the entire image, and an average orientation variation of the entire image.

29. The process, as in claim 25, where an extent of overlap one or more of the test and true sub regions is determined by any one or more of the following: a pixel-wise amplitude of the sub region, an average amplitude of the sub region, an image frequency of the subregion, an orientation of the sub region, an amplitude transition in the orientation direction, a local contrast, a local phase, a scalar quantization of intensity values of the sub region, a vector quantization of intensity values of the sub region, a dryness measure of the sub region, a smudge measure of the sub region, a quality of the sub region, an average amplitude of the entire image, an average frequency of the entire image, an average quality of the entire image, and an average orientation variation of the entire image.

30. The process, as in claim 25, where the characteristics are image characteristics that include any one or more of the following: a pixel-wise amplitude of the sub region, an average amplitude of the sub region, an image frequency of the subregion, an orientation of the sub region, an amplitude transition in the orientation direction, a local contrast, a local phase, a scalar quantization of intensity values of the sub region, a vector quantization of intensity values of the sub region, a dryness measure of the sub region, a smudge measure of the sub region, a quality of the sub region, an average amplitude of the entire image, an average frequency of the entire image, an average quality of the entire image, and an average orientation variation of the entire image.

31. The process, as in claim 25, where the characteristics are subject characteristics that include any one or more of the following: sex, geographical location, weather, income, profession, and genetics.

32. The process, as in claim 25, where the relation is determined by a human expert.

33. The process, as in claim 25, where the relation is one of the following: an identity, a non identity, a magnitude difference, an algorithmic relation, greater than, and less than.

34. The process, as in claim 25, where the characteristics are determined by a human expert.

35. The process, as in claim 25, where the characteristics are determined by an automated process.

36. The process, as in claim 35, where the automated process includes any one or more of the following: a signal processing technique, a comparison to an example set of images, ??

37. The process, as in claim 25, where the characteristics are predetermined.